United States Department of Agriculture • Forest Service

Northeastern Forest Experiment Station

Upper Darby, Pennsylvania
Ralph W. Marquis, Director

INTERMOUNTAIN STATION
Central Reference File
No. 0.73

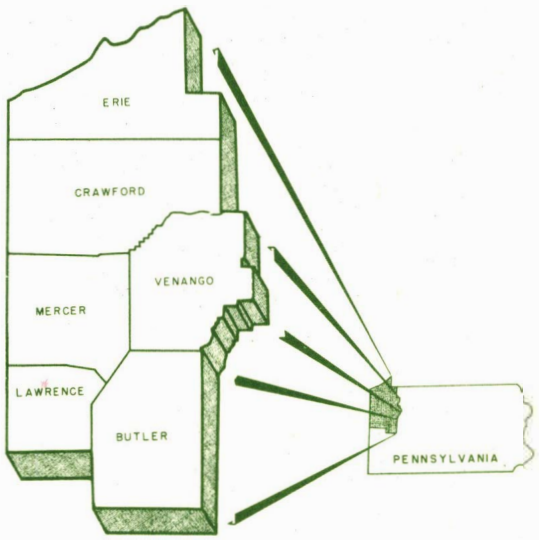
FOREST SERVICE
FEB 10 1956
RESEARCH
INTERMOUNTAIN

Forest Statistics

for the

Northwestern Section

of Pennsylvania



Forest Statistics Series
Pennsylvania No. 2

1955

FOREWORD

This is the second in a new series of reports about forest areas and timber volumes in Pennsylvania. It is a product of the Forest Survey of the Northeast, carried on by the Northeastern Forest Experiment Station as part of the nationwide survey being made by the Forest Service, U. S. Department of Agriculture.

The Pennsylvania State Planning Board provided the aerial photographs used in the survey. The Pennsylvania Department of Forests and Waters provided office space and gave other valuable assistance.

Field work in the Northwestern Section of Pennsylvania was supervised by N. B. Griswold. The statistical procedures used were developed by C. Allen Bickford. Computations were made under the supervision of Roland H. Ferguson.

Ralph W. Marquis

RALPH W. MARQUIS
Director

CONTENTS

	Page
GENERAL	1
Forest area	2
Ownership	2
Forest types	2
Forest stands	3
Timber volume	3
Pulpwood volume	3
TABLES	
Land area	4
Commercial forest-land area	5
Timber volume	7
Average volume per acre	9
Pulpwood volume	9
APPENDIX	
Definitions of terms	11
Forest survey methods	14
Accuracy of the estimates	14
Species tallied	15

Forest Statistics
for the
Northwestern Section
of Pennsylvania

Prepared By The

DIVISION OF FOREST ECONOMICS

Northeastern Forest Experiment Station
Forest Service, U.S. Dept. Agriculture

GENERAL

THE NORTHWESTERN SECTION of Pennsylvania includes six counties. Four of them--Erie, Crawford, Mercer, and Lawrence--border on the State of Ohio. Butler and Venango Counties lie to the south and east.

With the exception of a flat strip of land adjacent to Lake Erie known as the "Grape Belt," the topography of the four western counties is characterized by gently rolling hills. In Butler and Venango Counties, the hills are more rugged and steep.

Industry is greatly diversified in this section. Farming, dairying, manufacturing, coal mining, oil, and natural gas are the most important. Agriculture is prominent in Erie, Lawrence, and Mercer Counties. Field and orchard crops and dairy and chicken products are the basis of the agricultural economy of these counties. Manufacturing of steel and metal products ranks high in Mercer, Lawrence, Crawford, and Butler Counties. The petroleum and natural gas industry has dominated the economic life of Venango

County since the discovery of oil in 1859, and to a lesser degree, that of Butler County.

At the northern boundary is the City of Erie with the largest land-locked harbor on the lake, one of Pennsylvania's most important shipping and manufacturing centers. Just below the southern boundary is Pittsburgh, the second largest shipping and manufacturing center in Pennsylvania, into which flows much of the produce and products from this Northwestern Section.

Forest Area

The total land area in the Northwestern Section amounts to almost 3 million acres. Nearly one-third of this--979,000 acres--is forest land. Less than ½ percent of the forest land is reserved from commercial timber cutting.

The most extensively forested county is Venango, with about two-thirds of its area in commercial forests. Three counties--Erie, Lawrence, and Mercer--are less than one-fourth forested. The other two counties--Butler and Crawford--are about 40 percent forested.

Ownership

Practically all the commercial forest land in these counties is privately owned. Only 4 percent--38,200 acres--is publicly owned, and most of this is State Game Land. Municipal and county holdings are negligible, less than ½ percent of the total commercial forest land.

Of the privately owned forest land, farmers own about 40 percent, or 387,600 acres. The remainder--551,500 acres--is held by numerous small private owners. The largest private ownership is less than 8,000 acres of commercial forest land. A number of these private owners, especially in Venango and Butler Counties, are holding their land for real or anticipated oil and coal values.

Forest Types

Red oak and white oak types occupy more than half of the commercial forest-land area. About one-fourth of the forest area is in the sugar maple-beech-yellow birch type.

The other hardwood forest types--predominantly aspen and ash-elm-maple--make up less than a fifth of the forest land. Only 3 percent of the commercial forest area is in softwood types, primarily hemlock.

Forest Stands

Sawtimber stands occupy 29 percent of the commercial forest land; however, the medium and heavy sawtimber stands (5,000 or more board feet per acre) occupy only 6 percent. A large portion of the commercial forest area, 42 percent, is in poletimber stands.

The remaining 29 percent is in seedling-and-sapling stands and nonstocked forest areas. Much of this is due to the abandonment of farm land, especially in Butler, Lawrence, and Venango Counties, where about 12 percent of the area formerly in farms was abandoned between 1945 and 1950.

Timber Volume

Growing stock in the Northwestern Section of Pennsylvania amounts to almost 3/4 billion cubic feet. Of this, 406 million are in sawtimber trees and 340 million are in poletimber trees.

Included in this growing stock are 1,608 million board feet (log scale, International $\frac{1}{4}$-inch rule) of sawtimber. The oak species make up to 30 percent of this total, and the maples account for almost one-fourth. Other hardwood species together amount to 38 percent. The remaining 7 percent of sawtimber volume is in the softwood species, principally hemlock.

Pulpwood Volume

According to pulpwood specifications developed by the Northeastern and Appalachian Technical Committees of the American Pulpwood Association, practically all of the growing stock is suitable for use by the pulp industry--including some large sawlogs and veneer-log material. In terms of these specifications, there are 8.6 million rough standard cords of pulpwood bolts.

Hardwood species account for 92 percent of the total pulpwood volume. Almost 40 percent of this is in the "soft" hardwood species--principally red maple, black cherry, elm, and aspen. More than four-fifths of the softwood pulpwood volume is in hemlock.

Pulpwood stands averaging better than 5 cords per acre cover 65 percent of the commercial forest land. Of this about one-third carries more than 15 cords per acre. The remaining 35 percent of the forest area is made up of land having no pulpwood volume and other areas with pulpwood volume ranging up to 5 cords per acre.

Table 1.--Land area by major classes, 1953

Class of land[1]	Area	
	Acres	Percent
Forest land:		
Commercial	977,300	35
Noncommercial[2]	1,700	(3/)
All forest land	979,000	35
Nonforest land	1,801,800	65
All land[4]	2,780,800	100

[1]See Appendix for definitions.

[2]The entire acreage is in State Parks, reserved from timber cutting.

[3]Less than 1 percent.

[4]Census of Agriculture, 1950. Water areas of 1 to 40 acres are included in the estimate of nonforest acreage.

Table 2.--Land area and commercial forest-land area by county, 1953

County	Land area	Commercial forest-land area	
	Acres	Acres	Percent
Butler	508,200	192,000	38
Crawford	650,200	240,300	37
Erie	519,700	129,300	25
Lawrence	234,900	50,300	21
Mercer	435,800	86,600	20
Venango	432,000	278,800	64
All	2,780,800	977,300	35

Table 3.--Commercial forest-land area by ownership, 1953

Ownership class	Acreage held	
	Acres	Percent
Private:		
Farm forest land[1]	387,600	40
Other private	551,500	56
Total private	939,100	96
Public:		
State[2]	35,000	4
Municipal	2,900	(3/)
County	300	(3/)
Total public	38,200	4
All ownerships	977,300	100

[1]Census of Agriculture, 1950.

[2]Includes 34,000 acres of commercial forest land administered by the Pennsylvania State Game Commission as State Game Lands.

[3]Less than 1 percent.

Table 4.--Commercial forest-land area by forest type, 1953

Forest type	Area	
	Acres	Percent
Red oak	379,200	39
Sugar maple-beech-yellow birch	238,700	24
White oak	165,900	17
Aspen	83,400	9
Ash-elm-maple	70,300	7
Chestnut oak	12,500	1
Softwood types[1]	27,300	3
All types	977,300	100

[1]Includes 21,100 acres of hemlock type.

Table 5.--Commercial forest-land area by forest-type group and stand-size class, 1953

Forest-type group	Saw-timber stands	Pole-timber stands	Seedling-and-sapling stands and other areas	Total area
	Acres	Acres	Acres	Acres
Red oak	85,600	162,100	131,500	379,200
Sugar maple-beech-yellow birch	120,600	74,500	43,600	238,700
White oak	48,400	104,200	13,300	165,900
Other hardwood types	14,800	59,000	92,400	166,200
Softwood types	15,400	11,900	(1/)	27,300
All types	284,800	411,700	280,800	977,300
Percent	29	42	29	100

[1]No plots in the softwood types fell in this stand-size class.

Table 6.--Commercial forest-land area by stand-size class and drainage area, 1953

Stand-size class	Drainage area			Total
	Allegheny River	Beaver River	Lake Erie tributaries[1]	
	Acres	Acres	Acres	Acres
Sawtimber stands:				
More than 5,000 board feet per acre	47,300	9,400	5,300	62,000
1,500 to 5,000 board feet per acre	131,500	69,600	21,700	222,800
Poletimber stands:				
More than 600 cubic feet per acre	154,600	58,400	17,000	230,000
200 to 600 cubic feet per acre	119,900	43,100	18,700	181,700
Other areas	167,300	92,800	20,700	280,800
Total	620,600	273,300	83,400	977,300
Percent	64	28	8	100

[1]Includes 8,100 acres in the Upper Ohio River drainage area.

Table 7.--Net volume of live timber on commercial forest land by species, 1953

Species	Growing stock[1]	Saw-timber[2]	Suitable for pulpwood[3]
	Thousand cu.ft.	Thousand bd.ft.	Thousand cords
Hemlock	47,000	97,200	531
White pine	4,400	19,100	50
Other softwoods	6,200	3,900	70
All softwoods	57,600	120,200	651
White oak	123,200	210,300	1,427
Red maple	100,800	213,800	1,168
Sugar maple	78,000	178,100	904
Northern red oak	64,200	182,600	744
Black cherry	55,400	69,300	642
Beech	46,300	151,200	536
Elm	37,700	106,900	437
Hickory	32,300	70,000	374
Aspen	31,700	8,900	367
White ash	29,000	77,500	336
Black oak	20,700	59,300	240
Scarlet oak	11,800	34,200	137
Yellow birch	10,500	9,000	122
Yellow-poplar	8,800	30,300	102
Other soft hardwoods	20,500	58,600	238
Other hard hardwoods	17,700	28,300	205
All hardwoods	688,600	1,488,300	7,979
All species	746,200	1,608,500	8,630

[1] See Appendix for definitions. Growing stock includes pulpwood and sawtimber.

[2] Log scale, International ¼-inch rule.

[3] 4-foot bolts, including bark.

Table 8.--Net volume of live timber on commercial forest land by diameter class, 1953

Diameter class[1] (in inches at breast height)	Growing stock	Saw-timber
	Thousand cu.ft.	Thousand bd.ft.
Softwoods:		
6	9,100	--
8	9,900	--
10	10,900	28,600
12	9,300	25,400
14	3,900	14,900
16	6,600	19,500
18	4,600	16,800
20 +	3,300	15,000
All softwoods	57,600	120,200
Hardwoods:		
6	80,500	--
8	103,400	--
10	137,600	--
12	108,300	369,100
14	76,200	313,000
16	73,100	310,800
18	37,400	161,500
20	25,000	101,600
22	16,800	71,600
24	10,000	51,200
26	9,400	53,600
28 +	10,900	55,900
All hardwoods	688,600	1,488,300
Total	746,200	1,608,500

[1]The midpoint of each 2-inch diameter class is indicated.

Table 9.--Net volume of live timber on commercial forest land by forest type, 1953

Forest type	Growing stock	Saw-timber	Suitable for pulpwood
	Thousand cu.ft.	Thousand bd.ft.	Thousand cords
Red oak	274,000	545,400	3,169
Sugar maple-beech-yellow birch	242,700	636,800	2,807
White oak	133,400	227,500	1,543
Aspen	20,800	1,500	241
Ash-elm-maple	33,100	99,600	383
Chestnut oak	8,000	17,200	92
Softwood types	34,200	80,500	395
All types	746,200	1,608,500	8,630

Table 10.--Average net volume of live timber per acre of commercial forest land, by stand-size class, 1953

Stand-size class (and acreage of each class)	Growing stock	Sawtimber
	Cubic feet	Board feet
Sawtimber stands:		
More than 5,000 bd.ft. per acre (62,000 acres)	2,200	7,600
1,500 to 5,000 bd.ft. per acre (222,800 acres)	1,200	3,200
Poletimber stands:		
More than 600 cu.ft. per acre (230,000 acres)	1,000	1,100
200 to 600 cu.ft. per acre (181,700 acres)	400	500
Other[1] (280,800 acres)	200	200
Average, all classes[2] (977,300 acres)	800	1,600

[1]Includes seedling-and-sapling stands and nonstocked areas.

[2]Hardwoods constitute 92 percent of the total growing stock or 93 percent of the total sawtimber volume. The average cubic volume of the total commercial forest area is equivalent to 10 cords per acre.

Table 11.--Area and volume by pulpwood volume-per-acre class, 1953

Pulpwood class	Area	Volume
	Thousand acres	Thousand cords
Less than 5 cords per acre	341	599
5 to 15 cords per acre	441	3,952
More than 15 cords per acre	195	4,079
Total	977	8,630

APPENDIX

DEFINITIONS OF TERMS

Forest Area

Forest-land area.--Includes (a) lands that are at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting influence on the climate or on the water regime; (b) land from which the trees described in (a) have been removed to less than 10 percent stocking and which has not been developed for other use; and (c) afforested areas. (Forest tracts of less than 1 acre, isolated strips of timber less than 120 feet wide, and abandoned fields and pastures not yet 10 percent stocked are excluded.)

Commercial forest-land area.--Forest land that is (a) producing, or physically capable of producing, usable crops of wood (usually sawtimber), (b) economically available now or prospectively, and (c) not withdrawn from timber utilization.

Noncommercial forest-land area.--Forest land (a) withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualifies as commercial forest land, and (b) incapable of yielding usable wood products (usually sawtimber) because of adverse site conditions.

Forest Types

Forest types are classified according to the species or species group that accounts for the major portion of the stand in terms of cubic feet in sawtimber and poletimber stands, or the number of stems in seedling-and-sapling stands.

Stand-Size Classes

Sawtimber stands.--Stands with sawtimber trees having a minimum net volume per acre of 1,500 board feet, International $\frac{1}{4}$-inch rule.

Poletimber stands.--Stands failing to meet the sawtimber stand specification, but at least 10 percent stocked

with poletimber and larger (5.0 inches and larger) trees, and with at least half the minimum stocking in poletimber trees. (Poletimber stands carry at least 200 cubic feet per acre.)

Seedling-and-sapling stands.--Stands not qualifying as either sawtimber or poletimber stands, but having at least 10 percent stocking of trees of commercial species and with at least half the minimum stocking in seedling-and-sapling trees.

Other areas.--Forest-land areas not qualifying as sawtimber, poletimber, or seedling-and-sapling stands. (Includes nonstocked areas.)

Tree Classes

Sawtimber trees.--Trees of commercial species that contain at least one merchantable sawlog as defined by regional practice and that are of the following minimum diameters at breast height (d.b.h.): Softwoods 9.0 inches and hardwoods 11.0 inches. (All butt sawlogs are considered merchantable. Where the butt is defective, upper sawlogs are considered merchantable if they account--in terms of aggregate net volume--for 50 percent or more of the gross volume below the top of the uppermost sawlog. Softwood sawlogs are at least 6.0 inches in diameter inside bark at small end; 8 to 16 feet in length; sound and straight enough to be manufactured into standard lumber. The smaller logs are generally free of surface defects other than small tight knots. Hardwood sawlogs are at least 8.0 inches in diameter inside bark at small end; 8 to 16 feet in length; suitable for sawing into standard lumber, construction timbers, or ties.)

Poletimber trees.--Trees 5.0 inches d.b.h. and larger of commercial species that do not meet the specifications for sawtimber trees but do meet regional specifications of species, soundness, and freedom from defect. (These are the trees that are straight and clear enough to make sawtimber trees eventually.)

Seedling-and-sapling trees.--Trees of commercial species less than 5.0 inches in diameter at breast height.

Cull trees.--Live trees of sawtimber or poletimber size that are unmerchantable for sawlogs now or prospectively because of defect, rot, or species.

Timber Volume

Growing stock.--Net volume, in cubic feet, of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) inside bark.

Live sawtimber volume.--Net volume in board feet, International $\frac{1}{4}$-inch rule, of live sawtimber trees.

Pulpwood.--Net volume in rough, standard cords (bark included) of growing stock, excluding sound defect as well as unsound defect.

Pulpwood Volume

The pulpwood specifications used in this report are those set up by the Northeastern and Appalachian Technical Committees of the American Pulpwood Association.

Pulpwood trees.--Live trees of commercial species, 5.0 inches d.b.h. and larger, containing at least two contiguous pulpwood bolts and with 50 percent or more of the main stem volume usable for pulp. (A merchantable pulpwood bolt is a section of the main stem of a pulpwood tree, 4 feet long; 4.0 inches or larger inside bark at the small end; free from any indication of rot, charred wood, metal or hollow center; and contiguous to one or more sections meeting these same requirements. Crotches are excluded; sweep or crook in any section shall exclude the bolt if a line from the center of the top cut to the center of the bottom cut passes outside the wood at any point. Most of the sawtimber and poletimber trees are also defined as pulpwood trees.)

Pulpwood volume.--Net volume in standard cords (including bark), of the main stem of pulpwood trees, from the stump to a point where the top breaks up into branches, or to a minimum top diameter of 4.0 inches (inside bark). Deductions are made for all portions of the stem that fail to meet pulpwood bolt requirements.

Pulpwood Stands

Less than 5 cords per acre: Stands with trees 5.0 inches (d.b.h.) and larger that meet pulpwood specifications, and with a net volume per acre of less than 400 cubic feet. (Includes seedling-and-sapling stands and nonstocked areas.)

5 to 15 cords per acre: Stands with trees 5.0 inches (d.b.h.) and larger that meet pulpwood specifications, and with a net volume per acre ranging from 400 to 1,200 cubic feet.

More than 15 cords per acre: Stands with trees 5.0 inches (d.b.h.) and larger that meet pulpwood specifications, and with a net volume per acre of more than 1,200 cubic feet.

FOREST SURVEY METHODS

These forest statistics are based on information gathered from aerial photographs and from sample plots examined on the ground.

First, photo-interpretation plots were marked off on the aerial photographs. These plots were distributed uniformly by mechanical means over photographs of the entire district. Trained photo-interpreters then classified each photo-plot as either forest or nonforest. Forest plots were classified further according to stand-size and forest type.

Field crews inspected some of the photo-plots on the ground. Enough plots were selected at random so as to attain a specified level of statistical accuracy. Species and volume data were collected on these ground plots; and the photo classification of stand size and forest type was verified or--if necessary--changed.

The survey was designed for maximum efficiency in estimating total cubic volume to meet the national standards of accuracy.

ACCURACY OF THE ESTIMATES

The estimates in this report may contain two kinds of error. First, photo-interpreters may make mistakes of judgment and fieldmen may make mistakes in measuring or recording. There is no practical way of finding out just how often such errors occur. But they are kept to a minimum by closely checking all phases of the work.

The second kind of error is associated with sampling procedures. The size of this sampling error can be measured. In the Northwestern Section of Pennsylvania the probabilities are 2 out of 3 that the actual forest area is within $\pm$ 3.2 percent of the estimated forest area, that the actual cubic-foot volume is within $\pm$ 5.8 percent of the estimated cubic-foot volume, and that the actual board-foot volume is within $\pm$ 8.5 percent of the estimated board-foot volume. This does not include any mistakes in measurement or classification.

These percentages show that the area estimates are more accurate than the volume estimates, and that the cubic-

foot estimates are more accurate than the board-foot estimates.

In each of the tables, the total figures are more accurate than the subtotals. The subtotals are more accurate than any of the individual figures. Figures that are small in relation to totals are subject to larger sampling errors.

SPECIES TALLIED

The various commercial tree species tallied in the Northwestern Section of Pennsylvania are listed below. Approved common names[1] are shown in parentheses if they differ from the brief name used in the tables. Other tree species may occur in the area, but unless they were tallied on the field plots they were not included in the following list.

Softwoods

Hemlock (Eastern hemlock)	- Tsuga canadensis
White pine (Eastern white pine)	- Pinus strobus
(Red pine)	- Pinus resinosa
Other softwoods	
(Pitch pine)	- Pinus rigida
(Jack pine)	- Pinus banksiana
(Tamarack)	- Larix laricina

Soft Hardwoods

Red maple	- Acer rubrum
Black cherry	- Prunus serotina
Elm (American elm)	- Ulmus americana
Aspen (Quaking aspen)	- Populus tremuloides
Yellow-poplar	- Liriodendron tulipifera
Other soft hardwoods	
(Cucumbertree)	- Magnolia acuminata
(American basswood)	- Tilia americana
(Slippery elm)	- Ulmus rubra
(Butternut)	- Juglans cinerea
(American sycamore)	- Platanus occidentalis
(Sweetgum)	- Liquidambar styraciflua
(Eastern cottonwood)	- Populus deltoides
(Black willow)	- Salix nigra

[1]Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dept. Agr., Agr. Handb. 41. 472 pp. 1953.

Hard Hardwoods

White oak	- Quercus alba
Sugar maple	- Acer saccharum
Northern red oak	- Quercus rubra
Beech (American beech)	- Fagus grandifolia
Hickory	- Carya species
White ash	- Fraxinus americana
Black oak	- Quercus velutina
Scarlet oak	- Quercus coccinea
Yellow birch	- Betula alleghaniensis
Other hard hardwoods	
(Pin oak)	- Quercus palustris
(Chestnut oak)	- Quercus prinus
(Swamp white oak)	- Quercus bicolor
(Sweet birch)	- Betula lenta
(Black walnut)	- Juglans nigra
(Black locust)	- Robinia pseudoacacia

AGRICULTURE-FOREST SERVICE-UPPER DARBY